

Rethinking Technology — Alternative Outdoors Music Practices

low-carbon music practices, outdoor and off-grid musicking, socio-material arrangement, sustainable music infrastructures, DIY and grassroots cultural practices, mobility and participatory performance

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This article explores four grassroots low-carbon initiatives in outdoor music-making that may give an example of a new trend towards more sustainable ways of ad-hoc outdoor musicking. While environmental awareness regarding the music industry's substantial carbon footprint has increased, mainstream festivals continue to rely on large-scale, resource-intensive infrastructures, driven by growth-oriented innovation policies. In contrast, we investigate four small-scale case studies—HedgeRig (UK), GaiaStage (Finland), ExoSound (Finland), and Zero Carbon Records (Belgium/France)—that develop alternative performance practices grounded in mobility, minimal material reliance, and socio-environmental attunement. Drawing on Lucy Suchman's conception of technologies as socio-material arrangements, we argue that these initiatives shift emphasis from the materiality of technology to its social dimension, to enact sustainable modes of musicking.

Through a combination of ethnographic accounts and technical descriptions authored by practitioners themselves, the article demonstrates how these projects operate through lightweight infrastructures, off-grid energy systems, participatory sound-making, and bicycle-based mobility. Despite differences in motivation—from ecological activism to speculative design, experimental sound art, and DIY cultural histories—the cases converge in foregrounding relational, embodied, and situated engagements with technology and place. We show that such micro-practices not only propose viable low-impact alternatives to carbon-intensive festival culture but also model a broader rethinking of technological agency: technologies become negotiations rather than determinants, enabling practice-based pathways toward sustainable practices.

1. Introduction

Although environmental awareness about the high carbon footprint of the music industry is growing (Jones, McLachlan & Mander 2021), the industry runs festival events largely as before. If anything, events get bigger, and small venues continue to disappear (Liveurope 2025). Increasingly, album sales are replaced by music streaming services, providing artists with a fraction of their previous income (Teosto Ry 2024). As a result, there is a pressure for musicians to play profitable large-scale events.

In the efforts to move towards an environmentally sustainable future, major international policies show a bias towards material developments: The notion of innovation and technical novelty seems to be irreversibly linked to the making of new products, not practices. This is evident, for example,

in the European Union's Green Deal (European Council 2025), but also in the formulation of UNESCO's agenda 2030 (UNESCO 2022) that emphasises the importance of competitive economic growth. Investment is directed at new things, not new ways of being.

Yet, by example of four case studies (two from Finland, one from the UK and one from Belgium/France), we aim to show that low impact grass-root practices may constitute a new trend towards more sustainable ways of ad-hoc outdoor musicking that could help in the development of new ways of doing festivals: ExoSound (Uniarts Helsinki 2025a) is a research project in outdoor electronic music that develops outdoor practices with ubiquitous devices rather than new gadgets. Pedal-powered GaiaStage Uniarts Helsinki (2025b) develops low-tech performance practices with zero-carbon technologies. As a third case, we look at HedgeRig, UK multi instrumentalist Chris Pierssené's (Kris Whistling Treason, RSVP Bhangra) 12V travelling sound system, that draws on historic examples of such practices that established themselves as fringe phenomenons in the UK festival scene over the last 30 years, from Rinky-Dink's sound-system (Rinky Dink 2025), to Rimski's Piano bicycle (Rimski 2025) to battery powered Bhangra parties. The fourth example, Zero Carbon Records in Belgium/France, is a radical initiative that organises music events according to a zero carbon protocol.

We propose that these examples pioneer a rethinking of the role of technology, based on anthropologist Lucy Suchman's definition of machines as socio-material arrangements (Suchman 2007). The practices we describe here demonstrate a shift from the material to the social that makes technologies more sustainable. Rather than conceptualising technologies as entirely material entities, they emphasise a social dimension, enabling sustainable technical practices that require less materials. Technologies are not deterministic givens we have to adapt to, but material practices we can choose or refuse to perform. This makes them double edged swords, opening up the possibility for ethical *and* unethical use. But a socially navigated materiality can reduce the adverse impact of technical actions (pollution, waste, emissions, ill health) by being more social than material.

Arguably, any technology could be analysed as a socially navigated materiality. But Case studies in the field of music-practices lend themselves to the thematic of rethinking technology in this way, as social aspects in music are pronounced (music as a social activity), and the practices are highly technologised (recording technology, amplification, distribution). In the context of music festivals

— temporary technical ecosystems with the sole purpose of facilitating music practices, this interdependence of the social and the material is specifically pronounced.

The four cases, although defined through a shared *action* narrative, vary in their discursive frameworks. Whereas GaiaStage and Zero Carbon Records have a clear activist stance to raise awareness about climate issues, ExoSound's approach is a form of practice-led research where the action is aimed at a sensorial re-orientation experimenting with place-making and community-making. Similarly, HedgeRig facilitates an alternative context of music making enabling off-mainstream practices. ExoSound and GaiaStage are action research projects with an academic framing, adding a layer of complexity in the analysis: Whereas ideological motivations may be linked to certain theories, they are *implicit* in HedgeRig and Zero Carbon Records and hence embedded in the primary data. But they are *explicit* part of a framing in ExoSound and GaiaStage. Action research follows two imperatives: Research, problem solving. What is more, action research can also research the validity of the framing ideas that guide both imperatives (Wilding 2015), which, in turn, may be applicable to all forms of action present in our cases.

Below, we will look at the background of environmental off-grid and mobile outdoors music practices, followed by individual descriptions of four cases that are consequently compared in a short analysis. The case descriptions are authored by individual members of those initiatives, the consequent section by the first author discusses how the cases relate to the overall theoretical framing of the article.

2. Background

In *Human-Machine Reconfigurations: Plans and Situated Actions* Lucy Suchman (2007) makes a compelling case that technologies are performed, contingent, relational *socio-material arrangements* in a quite literal way, questioning that *technology in itself* is even a plausible concept. Drawing on, amongst other sources, Keith Grint and Steve Woolgar's *The Machine at Work* (1997), the salient point here is that the anti-essentialist conception of technology does not make a differentiation between technology as an engineering concern and "technology's role in society". Rather, "the boundary between the social and the technical is part of the phenomenon to be investigated" (Grint & Woolgar 1997) and "the rule which we must respect is not to change registers when we move from the technical to the social aspects of the problem studied" (Callon 1986).

Suchman, using an example in Grint & Woolgar (1997), shows how a stereotypical engineering stance in technology-development often defines the user as an outsider to the technology as a generalised formulation to establish contrasts between insiders and outsiders. Through this exclusion of the user from the engineer's inside view, the machine (a socio-material arrangement) is (seemingly) becoming something external to its constituent social actor-network and it emerges as a (scientific) object outside of its context, hence allowing to *configure the user* according to the machine making the latter a determinant force impacting on society: "The user's character, capacity and possible future actions are structured and defined in relation to the machine" (Grint & Woolgar 1997, 92).

What Suchman takes away from this is Grint & Woolgar's metaphor of *machine as text* "insofar as the machine's inherent interpretive flexibility recommends the analogy of design as writing to reading as use. The aim of the metaphor is to destabilise the machine as object, to treat the design/use relation as an uncertain and problematic one, and to open the latter to investigation." (Suchman 2007, 191) Particularly the notion of de-stabilising the design/use relation is a recurrent theme in the description of the socio-technical practices we describe in this paper.

Situating the short case studies of this paper in a Science and Technology Studies (STS) context allows a look at the cases as such socio-technical practices where the emphasis moves away from cultural outputs as the products of technologies to the technologies and how they are socially constituted. And along with the STS stance comes the opportunity to explore if we are in a period of paradigm-change in technology (Kuhn 1962) and if we see traces thereof in the four cases.

As authors from different fields of music, musicology, sociology of music, and music technology, we are all active practitioners in at least one of the case studies described. We thus rely on autoethnographic methods for much of our data (Bochner 2022). Although music and sounding in itself is at the centre of all our individual practices, for this paper we shift the focus away from musical *content* towards practice *per se*, although they are of course inextricably linked through the practices' technical nature. But rather than giving, for example, an analysis of genre, aesthetics, or semiotics, we are motivated through a shared concern for environmental sustainability of musical practices. This stance aligns us with the premises of action research (Wilding 2015) in sustainability science (Vries 2024), defined by the practical problem it addresses. As regards the framing of the socio-materiality of the four cases, the question is not only ontological but *ethical*: If

a technology has the potential to be more sustainable than another it becomes an empowered choice to embrace it or refuse it rather than a predetermined given we have to abide to.

For the purpose of this paper our approach is thus more ethnomusicological (McKerrel 2022), than ecomusicological, despite the consonance with the field and its concerns that “the environmental crisis is not just a crisis of science (failed engineering), but also a crisis of culture (failed thinking), so we need to muster all possible humanistic and scientific resources in order to imagine, understand, and confront it.” (Allen & Dawe 2016). However, we concur with caution as ecomusicology’s and particularly the related field of ecocritical musicology’s interest in the “human-nature relations as mediated by music/sound” (ibid.) relies on a dichotomic view of “us” and “nature”. Rather, we aim for an understanding of musical practice beyond such a divide as a contributing environmental and complex factor within a socio-economic and material ecosystem.

The cases also resound with maker culture (Nascimento & Pólvara 2018) and its potential to change the technology paradigm towards a more sustainable and social conception — less through association to institutional *maker labs*, or similar, but through an affinity for and reliance on, shared knowledge in form of creative commons, shared how-to videos, internet fora, and exchanges of ideas within the communities.

2.1 Outdoor and Off-grid Music Events in Finland

(Alejandro Montes de Oca)

In Finland, statistics for the environmental impact of large outdoor music festivals are available: Flow Festival, Pori Jazz, Provinssi, Ruisrock, Ilosaarirock and the Worlds Village Festival are examples of large scale events that have been awarded with environmental certificates or have been recognised for environmental work (Salomäki 2020). The value of environmental accountability is recognised, and used in image building: Kuhmo Chamber Music Festival (Lumme energia 2022) and Solstice Festival (Solstice Festival 2025), for example, are medium scale music festivals organized with an emphasis on sustainability in their production methods. Although Kuhmo Chamber Music Festival advertises itself as a “festival surrounded by clear lakes and deep forests,” it takes place in conventional classical settings (a church, a cultural center and a primary school). The Solstice Festival in Ruka, near the winter sport resort of Kuusamo, is taking place outdoors, but advertises the fact that it is only 25 minutes away from the international airport more prominently than its environmental commitments. Not surprisingly, all these festivals mainly

compensate for its carbon footprint with environmental projects. More hands-on efforts concern the use of renewable energy, offering more plant-based catering options, aiming for circular economy systems, waste reduction, and resource-efficient practices. In summary the carbon footprint is far away from being zero. Presenting international artists causes a large amount of the carbon emissions by the artists' flights. However, the general public, staff and local artists are encouraged to travel by public transport, train and bicycle (Hiltunen 2018).

In contrast, detailed information for off-grid outdoors music making practices is scarce. Some of the reasons for this lack of information are the smaller sizes of the events, their underground nature, and they may be the actions of smaller groups of people. Typically, these events also take place in remote places. Despite this, there are examples of CO2-free initiatives like fiddler Emilia Lajunen, who undertook a concert tour in Finland by bicycle in summer 2015. In two months Emilia had more than 20 concerts and cycled over 2000 kilometers (Lajunen 2015).

Another notable exception is the artist Association Mustarinda, who "promote the ecological rebuilding of society, the diversity of culture and nature, and the connection between art and science". The Mustarinda Association also publishes an online magazine on ecological concerns in the arts, working with practical experiments, education and community work (Mustarinda 2026).

The award-winning non-fiction writer, energy expert, inventor, and entrepreneur Janne Käpylehto has been at the centre of a series of off-grid and/or alternative energy projects. The Energy Soundscapes event at the Theatre Academy in 2017 involved Janne Käpylehto, accordionist Kimmo Pohjonen and electronic musician Tuomas Norvio ([Yle 2017](#)). On this occasion the energy needed for the stage was produced by pedal-power bicycles, sewing machines, and treadmills. In 2019, the energy company Väre organised a free concert at the Allas Sea Pool in Helsinki center (Väre Oy 2019). Käpylehto converted 20 conventional bikes into electricity-generating bikes, and the audience was able to pedal to provide the electrical energy for the stage where the artists were performing. For the Frozen People festival of 2022 (Mäki-Heikkilä 2022), electricity for the electronic music and arctic art was provided by Käpylehto with a hybrid power plant (solar, wind, and pedal power) Another example of pedal-power generators for off-grid music making events was the Käpylän Elojuhlien festival in August 2022, where the OmaVaraLava (own reserve's stage) also was powered by the audience pedalling on bicycles ([UusioUtiset 2022](#)).

The Finnish forest has also been the place for some off-grid underground electronic music events. A good example of this kind is the Metsä Dub group that organise forest dance parties with the Ivah Sound system. The electricity provided for the custom built sound system and light is produced by a diesel generator, so their carbon footprint is also far away from being zero.

2.2 A Brief History of Off-Grid Culture in the UK

(Chris Pierssené)

The history of off-grid music making and entertainment in the UK is inextricably linked with New Traveller culture. Arising from the free festivals of the very late 1960s and 1970s, joined by a later influx from the rave scene, a new nomadic culture arose in the UK, drawing inspiration from a heady mix of modern Paganism, environmentalism, hedonism and pre-existing, traditional travelling cultures (George Smith 2019). A mobile life-style, with homes built into repurposed vehicles, necessitates an off-grid power supply, and New Travellers swiftly became early adopters of green technologies. For example, one of the UK's major solar and off-grid retailers, Bimble Solar, finds its origins in a festival stage.

Whilst petrol generators were, and indeed still remain nearly ubiquitous, the off-grid approach has found strong support at some major events; Glastonbury Festival's Green Fields area is a major player (Ben Smith 2025). Other notable off-grid events, past and present, include the Green Gathering (Green Gathering 2025) and the Croissant Neuf Summer Party (Croissant Neuf 2025). Indeed, in terms of UK alternative technology based sound-systems, Croissant Neuf must come in for a special mention as pioneers in the field. With their roots in the 1980s, they now span 3 generations, and have developed huge technical expertise. Their stage is a joy to perform on. A further honourable mention should go to the venerable Rinky Dink sound system (Rinky Dink 2025), a pedal powered system built onto a train of bicycles, which can be cycled about. This is an obvious forerunner to Dom Whiting's Drum and Bass on the Bike rides (Whiting 2025), which combine massed cyclists with a participatory element; attendees are invited to bring their own mobile speakers and broadcast a livestream as the group cycles about a city.



Image 1. The Hedge Rig. Source: Chris Pierssené.

A further major element in contemporary off-grid music has its origins in the DIY ethos of reggae, a foundation on which nearly all UK dance music rests. The reggae sound-system generally features hand built speaker boxes tuned specifically for the genre, and an individual approach to design is preferred, each sound-system operator hoping to reproduce the music to greater effect than his rivals. Although the majority of reggae sound-systems will run off 240v mains electric, the diy ethos of speaker building has fed into the off-grid scene, and many enthusiasts will demonstrate their systems with bass heavy dub reggae.

3. Four Case Studies

The following four case studies, written by and with participants of the individual initiatives, describe mobile, low-carbon, sustainable, and alternative grassroots practices that share a DIY ethos and maker culture. Organised as flexible, non-hierarchical micro-groups they emphasise participation in musical events as holistic socio-cultural activities. Even if the individual motivation may vary, they exemplify how shared cultural values can be a motor for alternative material action. In the discussion following the description of the cases, we will look in more detail how this material action affects the socio-material arrangement each case instantiates, and how they exemplify a rethinking of technology as a more social than material practice.

3.1 Case HedgeRig UK

(Chris Pierssené)

Inspired by many of the notables of the UK scene mentioned above, I started assembling the components of what would become HedgeRig in 2024. Choosing to run everything off 12v was an easy decision after living on a boat for 15 years. Not only did I have the technical knowledge, but I also still owned many useful components. The heart of the system is a Class D car amplifier, built by Pioneer. I chose to run this from a 100Ah LiFePo4 battery. This can be charged either by a 100w solar panel via an MPPT charge controller, or via the mains electricity supply before heading out. I bought the sub speaker ready built, and the tops were donated by a friend.

Due to the efficiency of the Class D digital amplifier and battery I estimate that I can run HedgeRig for around 8 hours at high volume on a full charge, but I've yet to run it for more than 4 hours. Obviously on a sunny day the solar panel will top up the battery as you go.

So far the HedgeRig has been used for live performances by my bands RSVP Bhangra (RSVP Bhangra 2025) and Whistling Treason (Whistling Treason 2025), as well as various other supporting acts. Concerts have been held in fields, woodland, and by the Portway road running along the Avon Valley in Bristol, all places with no access to 240v power. For the future I plan to buy or build new top speakers, and make the whole thing more mobile by buying a rickshaw to transport it all on. Whilst it can all be transported on one bicycle trailer, it's somewhat precarious!



Image 2. Bristol Portway, where RSVP Bhangra played on the HedgeRig as part of the Great Bristol Run half marathon 2024. (Judge Singh, Rana Dildar Singh, Chris Pierssené). Source: Chris Pierssené.

3.2 Case GaiaStage

(Dominik Schlienger)

GaiaStage came into being as a speculative design in 2021, while working on a theoretical thesis on ethical responsibility in technology (Schlienger 2022). The idea was motivated from the question of what can be done *practically* in response to the question of how a less carbon extensive music industry could be possible. Imagining future scenarios and possibilities for such a stage through speculative design (Dunne & Raby 2013) the focus was on exploring social, political, technological, and ethical issues. Speculative design is critical — rather than just problem solving it is about

problem finding, rather than science fiction it suggests social fiction, not just *applications* but *implications*. Accordingly, we envisaged ways to radically “do stages differently”, pedal power being one idea of various others, stages that sail from event to event and flywheels made of recycled water bottles being other plans in the making.

GaiaStage was chosen for the *University of the Arts Helsinki Pre-Incubator* (Uniarts Hub 2025), a program to develop art-based business ideas in 2022. As part of this course it became clear that a not-for-profit association with the aim to develop, build, and run low carbon performance stages was the right organisational form, to clearly distance itself from the idea that ecological sustainability and economic growth are systemically congruent. Consequently, Gaia Stage Ry was registered on 2.2.2023.

After presenting the project as an academic endeavour at the Music, Research & Activism conference in Helsinki, the very first instantiation as a pedal-stage took place on 12.6.2023 at the Sustainable Science Days 10.6 at Aalto University and 12.6. at University of Helsinki.

In August 2024, the first Zero-Carbon Karaoke event took place at the Norpas festival on Kemiönsaari, with 2-bikes/generator stations, followed by events at the town-fetes of Helsinki (Helsinki-Day (12.6.) and Espoo (Espoo-Day, (29.8.) in 2025), both of which were awarded support by the cities. At Norpas Festival in August 2025 GaiaStage introduced a bigger stage setup, incorporating sensor-interaction technology, and in September 2025 ran for the first time a larger stage with 5 bicycle-generators, providing electricity for a 1000W system, at Kontulan Kulttuurin Ostari (Helsinki (2025) (coinciding with the Kontula Electronic festival (Kontula Electronic 2025)). This event too, was awarded support by Helsinki City.



Image 3. GaiaStage "Zero Carbon Karaoke" at Espoo-Day 2025 on Rövaren Island, a small uninhabited recreational Island off the Finnish South coast, accessible by public transport ferry from May-August. Source: Dominik Schlienger.

The imperative to go towards zero-carbon at the core of the project is essentially driving all consequent decisions in design, logistics, and organisation. So rather than trying to make existing practices more environmentally friendly, GaiaStage develops alternative practices.

Despite the academic framing, the technologies of GaiaStage are low-tech, and most materials are re-cycled or up-cycled. Rather than custom made bicycle generators, the generator stands (modified training stands bought second-hand) accommodate standard road/mountain bikes. The largest stage, consisting of 5 generator stands, 4 loudspeakers, a subwoofer and a party-tent, fits onto three bicycle trailers. The bicycle trailers are of the type used to carry kids, as they are the most ubiquitously available on secondhand markets. They also have the advantage that when transporting the stage on public transport (in the Helsinki Metropolitan Area regional trains and Metro) they blend in with all the other bikes and kids-trailers, raising less eyebrows with some members of the public who may deem the transport of goods inappropriate on commuter trains.

Transport is by far the largest source of pollution in the GaiaStage set-up if it cannot happen via public transport. Many strategies have been explored, but keeping the equipment light and small is key, along with making use of equipment that can be found and used on site. If the use of a car is unavoidable, it may be more efficient to use a trailer and fill the car with people, and, vice versa, if only two people are travelling, we avoid the use of a trailer and pack the gear in the car, for

example. For larger distances, and international collaborations, the idea is to organise workshops in other countries, building a local infrastructure *in situ*, rather than transporting the equipment.

Although audio amplification accounts for a comparatively small part of the overall energy required for a stage, it is also where a lot of energy is wasted in conventional off-grid setups: Standard electrical equipment works on alternating current (AC) as supplied by the electrical grid (In northern Europe, 220-230V as standard, or 360-400V for industrial appliances) making the use of inverters necessary, that convert the direct current (DC) provided by most pedal generators, wind-turbines and solar panels typical for off-grid settings, to AC. But most audio equipment converts from AC to DC inside the appliances. In this conversion, a lot of energy is wasted as heat. By using class D amps from in-car sound systems and other equipment that runs natively on DC, GaiaStage saves up to 30% energy in comparison to the same type of equipment running via inverters, simply by eliminating the need for multiple AC-DC conversions.

Further efficiency improvements are achieved by arranging the audience around the stage rather than in front of the stage, using the fact that loudspeakers are point sources, even if they show some directional behaviour: Rather than being lost as "noise" behind the stage, the audience moves into the radius of the speakers' reach, hence making use of the otherwise "wasted" sound-energy. Similarly, a higher number of spatially distributed smaller loudspeakers are more efficient than big loudspeaker fronts.



Image 4. Arttu Partinen (*Mental Alaska, Artsy Records*) performing with *C-Cassettes* on *Gaiatage* at *Kontula Kulttuuriostari 2025*.

One more technical characteristic of GaiaStage is the deliberate absence of chemical batteries. Charging chemical batteries by pedalling is inefficient due to the long duration of charging cycles (Battery University 2025): Even if the amount of energy required to charge a battery is within 80% of what can thereafter be extracted from the battery, the pedalling action would have to continue during the whole cycle of between 4 hours to top up a partially empty battery and 24 hours for a full charge from empty (55 Amp-hours lead-acid battery). At a leisurely pedalling pace, a healthy adult will provide around 50 Watts even when not trying hard at all, so an enormous surplus of power would be wasted during most of the charging cycle. In 24 hours, the pedalling would produce 1200 Ah, a waste of 1145 Ah. This is not so problematic once the battery is full, but if the battery is depleted, the cyclist has to cover the bulk charge and the charge the stage needs. What is more, the buffering of the energy hides the immediate relation of kinetic energy and audio amplification that is typical for GaiaStage performances: The performers need to motivate the audience members who are pedalling to pedal harder, when more power is needed. A different story would be the use of a flywheel as a buffer — as flywheels store kinetic energy *kinetically*,

there is no direct energy loss while charging, and the energy transfer's efficiency is close to 100%. Also, the energy stays *visible*, in the form of a rotating wheel.

Remains to ask what's in a name? Thematising the interdependence of systems, the 'Gaia' in GaiaStage refers to Bruno Latour's reading (Latour & Porter 2017) of James Lovelock's Gaia Hypotheses (Lovelock 1995) whereby our technical actions make or break the potentially resilient balance between all contributing actants on our planet.

3.3 Case ExoSound

(Otso Aavanranta & Oleksandra Nenko)

The ExoSound project explores an outdoors, off-grid, collective electronic music practice that breaks with the traditional studio paradigm generally associated with electronic music. The motivation to take music making outdoors, is to integrate the environment as a sonically contributing player as well as to instantiate a sonic place not as an imposed sonic appropriation but as a negotiated and collective activity.

Otso Aavanranta started developing a practice of outdoor electronic musicking around 2020. The motivations stemmed from a desire to expand the media-artist's frame of working with the outdoors, and a wish to profit from the mobile technologies potential and shift from studios, screens and desks to a more diverse agency within the material world, as well as an aesthetic magnet: electroacoustic music speaks a textural language akin to soundscapes and the aesthetic experience is heightened by multimodal engagement with the environment. The original impetus for developing an outdoor sonic practice came from participating in the 2010 "Modulation" radiophonic camp in the French Alps, organised by Julien Clauss, and active since 15 years by the time of writing (Modulation 2025).



Image 5. ExoSound on Malklasaari off Helsinki. (Alejandro Montes de Oca, Otso Aavanranta)

Source: ExoSound.

At its onset, the idea was to make use of mobile audio technologies at hand and develop a practice of outdoor electroacoustic music. A simple move in appearance, the shift to an outdoor setting has important consequences. In the first place, the transfer questions the very fundamentals of studio-based sonic arts. Electronic music is historically and, until recently, technically paired with the built environment and its related infrastructure, presupposing the silent, individually-focused, laboratory-like listening conditions of the studio space (Schedel 2012), defined performer and listener positionalities (Lehmann, Cádiz & Long 2022), reproducibility of the sonic object (Suisman & Strasser 2010; Benjamin 2018), as well as the according technological formats and standards. Moreover, moving the electroacoustic practice outdoors embeds it into relationality. The technologically mediated sound practice intertwines with the native soundscape of the location; a multitude of noises and voices – of human and non-human origin – wrapped into the rhythms of everyday circulations of the urban material infrastructures, live scenarios of nature dwellers and social interactions of humans. The sound work attends to, and becomes part of the soundscapes it works with. Outdoor music-making creates a halo of attention around these native sounds, accentuating the differences as well as correlations between them. The action-perception loop of listening and sounding creates favourable conditions for an emergence of a sphere of attention, enveloping musicians and listeners into a shared space of attentiveness. The currents and rhythms

of the environmental setting become more perceived and more listened to during the sounding practice, creating more emotional and sensual engagement with location, which becomes a place through experiential rooting.

Place sensibility and, wider, place identity are nurtured in the practices of careful listening and music-making, especially in a participatory setting. Taken as a ritualistic space, and in relation to its indoors “concert hall” counterpart, the outdoor, mobile space of musicking deploys numerous shifts and openings, involving the positionalities and agencies of sounding, listening, moving, relating from human participants and non-participants, as well as non-humans. The practice also interferes with politics of space and policies of sound, such as creating spaces and social contexts that are open and welcoming to sonic intervention and attunement, as well as probing contexts where additional sound layers are unusual or even problematic (example: what kind of sound work would one do in an almost completely silent national park in the dead of winter?).

One particularly exciting strand emerging from the outdoor music practice concerns perceptual cross-overs, especially between the auditory and the visual. On several occasions, people who have attended one of the outdoor music sessions have reported shifts in their visual perception, or a more general feeling of a shift in the environment, stemming from its visual appearance. It is as if the electroacoustic music, with its refined sonic textures and its invitation to attunement and attention would have an agency on the visual perception, making the visual scene appear non-ordinary, somehow out-of-place, unusual. A possible way to theorise the phenomenon would be to point to the perceptual nature of sound as a “non-object” – rather an aural “field” or “continuum” from where perception carves out salient features and cues. Sounds are traces, follow-up phenomena resulting from a primary object and cause, suspended in a field of in-betweenness. For Salomé Voegelin (Voegelin 2018), sound constitutes the paramount relational medium. The ExoSound field work suggests that, upon specific conditions of attunement, outdoor sound work can start to influence the objectifying, delineating visual mode of perception and re-shape the entire perception of a given place.

The ExoSound technical approach is designed to build on existing technologies and devices. The idea is to repurpose virtually ubiquitous personal mobile technologies such as smartphones and pads towards shared live sonic creation, with a meta-level intention to counter the mobile devices’ tendency of creating “personal bubbles of attention” and explore their potential as mediators of aesthetic-social engagement. ExoSound makes use of Samsung Android and Apple iOS mobile

devices and their related audio app resources. Portable bluetooth speakers are used for diffusion, including B&O A1, Minirig, JBL Clip 3 units, as well as and custom made wireless loudspeakers. The research team has tested a fair amount of audio applications available online, with priority given to apps geared towards more experimental or electroacoustic approaches. Examples include the “Animoog Z” synthesizer, the “Flip” sampler, the “Caustic” rack-mount synthesizer/sampler, as well as the “Borderlands” and “SpaceCraft” granular synthesis samplers. Mixdown within one device is generally done with the “AUM” app, and for networked signal flows between devices, the team agreed to use the “SonoBus” app.



Image 6. ExoSound at the Siirtymä Ambient Festival 2025 in Tampere, Finland. Alejandro Montes de Oca, Dominik Schlienger. Source: ExoSound.

Another direction we explore in the ExoSound framework is browser-based audio app design. Regarding ease of use, shareability and accessibility, web audio offers significant advantages: While native applications need to be downloaded and installed individually on each device, according to operating system, version specification and specific user account, a website is readily and immediately accessible to all devices with an internet connection and a browser. *Web Audio*

(Mozilla 2025) is a JavaScript application processing interface for audio processing and synthesizing in web applications. It provides wide possibilities for in-browser audio operations, such as input, output and more complex signal routing, sound processing and synthesis with low audio latency. The ExoSound project is currently working with browser-based sound libraries accessible to users on-site via a simple QR-code link, allowing them instant access to playable files. Near future developments focus on the capacity to edit these files in real time, and record and distribute sounds between devices.

The circulation of sounds from environment to players via several stages of processing back to the environment is a key element to integrate an ecology of co-sounding into the practice. An individual sounder becomes embedded into a network of sonic connections, listening and adding their own voice into the situated aural environment. Technology, then, becomes a mediator of socio-environmental flows.

3.4 Case Zero Carbon Records B/F

(Manu Louis and Sylvain Chauveau, interviewed by Dominik Schlienger)

The initiative "Zero Carbon Records," (Brass Centre Culturel de Forest 2025) aims to explore low-carbon practices in music amidst ongoing ecological concerns, particularly in response to the climate crisis. The project began in 2020 during the pandemic when musician, singer-songwriter, and composer Manu Louis, and musician, artist and composer Sylvain Chauveau collaborated on an anti-label concept in long lock-down video-calls: How can we produce music without relying on fossil fuels or electricity.

Sylvain Chauveau and Manu Louis' approach is influenced by 20th-century avant-garde artists like George Perec, Steve Reich, Morton Feldman, also filmmaker Werner Herzog, and the 1980s punk DIY ethos — in essence, art that works with restrictions, and thematises them as a human condition. Reflecting the conditions of depleted resources, and imperative to save our existence in the climate crisis, Zero Carbon Records organise performances and shows that do not use electricity for audio amplification at all, and insist on sustainable travel methods, primarily through cycling: 60% of all electricity is still produced through the burning of fossil fuel (Our World in Data 2025), to be zero carbon, the use of grid electricity has hence to be avoided. Artists who are willing to perform for Zero Carbon Records, have to subscribe to the *Zero Carbon Records Concerts Protocol*, whereby artists travel and transportation must be CO₂-free (by bicycle, on foot, or other

means) and the concert itself shall use no electricity, except if it is 100% carbon free. So in most cases, no amplification or sound system, and no lighting. There are unavoidable carbon emissions that are tolerated according to the protocol, but they have to be declared and named as *carbon fiascos*. From this protocol derives a series of mandatory rules, e.g., the concert's set has to be entirely acoustic or adapted to low-tech, carbon-neutral amplification. Importantly, the carbon free transportation has to be publicly documented on social media (admittedly a carbon fiasco, hence declared as such) and at the beginning of a concert, the artist(s) have to explain that the journey is part of the performance. Documentation has to show the artist leaving by bike or on foot (photos, videos, texts).



Image 7. Manu Louis and Sylvain Chauveau, with all their equipment on a Zero Carbon Records tour. Source: Zero Carbon Records.

To date, Manu and Sylvain have conducted two Zero Carbon Records bicycle tours in performing acoustic shows while traveling by bicycle, markedly reducing instrumentation to what they were able to take with them on two bikes.

The tours helped them in developing the concept and to understand in detail what is involved. The first tour was 3 weeks long, with dates in Belgium, France and the Netherlands. As distances were large, this amounted to 8 gigs within the 3 weeks. What is more, as the gigs were by definition acoustic only, the audiences had to be small, as the acoustic instruments they took with them (guitar, minibongos, harmonium) are not particularly loud. From an economic perspective, that is a disastrous endeavor: How to make a 3 week tour (21 overnight stays and food for the artists) financially viable if there are only 8 concerts with an audience of 20-50 people without having to ask for unrealistic ticket prices?

The second tour was more modest, 3 dates in one week, all in Belgium, but still 2 days to cycle between venues. It was also in June, when the weather is warmer, and there is more light, so no artificial lighting needed for the performances. Although the idea was to have shorter distances between the events, the problem is that with music that is stylistically off mainstream, finding venues and audiences is challenging, and opportunities are not available in every village.



Image 8. Manu Louis performing acoustically on a Zero Carbon Records tour. Source: Zero Carbon Records.

Key to the project is the need to balance artistic ambitions with the realities of access, audience engagement, and shared responsibilities in actually doing something in response to the climate crisis: Artists and societies must question their practices and impacts comprehensively. A sustainable practice within the existing economical framework, requires individual accountability in addressing carbon emissions through collaboration within the art community for solutions.

The question of freedom

In the interview I suggested that the crisis we find ourselves in is linked to our near-religious relation to fossil fuel: In the essay *Energy and Experience*, Salminen & Vadén (2015) posit that God had been replaced by Oil. Manu Louis responded that besides our belief in Oil it is *the religion of freedom* — the belief that we can burn everything *because we have the freedom to do it* — is to blame too: A type of libertarian thought only possible when there is enough oil and money. Zero Carbon Records takes a clear stand against this, by setting clear non-freedoms and restrictions to its artists.

In lieu of the fossil free-for-all, anything-goes, bonanza, a broader council should be found, to engage more voices in the discourse on carbon emissions and zero-impact performances, making the necessary restrictions on an ethically negotiated basis.

Zero Carbon Records has applied for Horizon Europe funding to finance an extensive tour, including Portugal, France, Finland, and Ukraine. Subject to funding success, they will collaborate with GaiaStage to provide the stage infrastructure.

3.5 Commonalities and Differences in the Four Cases

Summarising the four cases, the common themes are mobility, organisation as micro groups, and an undeferential attitude towards commercial mainstream practices. The four cases constitute alternatives chosen in an activist stance, suggesting new practices, new ways of doing music. Their motivations may vary — GaiaStage and Zero Carbon Records, for example, have a clear political agenda within a broader climate action effort, whereas ExoSound starts from an aesthetic, artistic wish for change — the implications are shared: All initiatives are run by active musicians, who seize the technological means of production in a form of maker culture to materially reinvent their musical practice. Rather than consumers, or users, who buy into existing technologies, they choose to make their own tools according to their needs — needs that demand more mobile, lightweight,

low impact and versatile technology than what mainstream practices are providing. In case of Zero Carbon Records, this involves the abandonment of the majority of technologies, in case of GaiaStage the re-invented infrastructure becomes its own artistic means, but both projects embrace a form of bicycle culture and its aesthetics. Although maker culture is a clear common denominator, there are obvious cultural differences: HedgeRig is embedded in New Traveller culture and part of the existing and thriving UK alternative festival scene, Zero Carbon Records links to the late 20th century and contemporary avant-garde, whereas the Finnish projects have to find an establish their own scene in more individualistic and less populous cultural surroundings.

4. Discussion

Returning to the theoretical frame of the socio-material arrangement, the four cases show how technology as an engineering concern and technologies' role in society cannot be *thought separately*. Entangled in the material framings of festivals, venues, studios and or their absences, and the aesthetics of electronic music, sound systems, stage shows, "the boundary between the social and the technical is part of the phenomenon to be investigated" (Grint & Woolgar 1997). This is, by definition, true for all technologies – but there is an essential difference the four cases exemplify: Let us start here from the premise that *machines are texts* as Grint & Woolgar and Suchman suggest. Whereas, arguably, the established industrialised music industry purports the narrative of a technological paradigm where all solutions are given as products and processes to which the musicians as users and consumers are outsiders, the four cases narrate a far more critical arrangement, treating "the design/use relation as an uncertain and problematic one". So from the simple account and description of the four cases' practices it becomes clear how the socially negotiated use of technology leads to sustainable and low impact practices that do not rely on a deterministically defined notion of technology. The process of rethinking technology is then to not exclude seemingly low-tech practices as irrelevant for technology at large, but to understand them as important *constituent drivers*, as more social than material constituents of technical arrangements. Consequently, a shift away from material to more social practices is mirrored in the direct beneficial effect on sustainability.

The social conditions that enable the four cases are not the same for all of them. A comparison of the background in the UK with Finland, for example, shows a cultural difference: Whereas off-grid, low carbon initiatives in the UK can occupy a niche in the larger festival-scene, the Finnish projects'

communities are smaller in scale, which isolates them, and makes them reliant on institutional funding. Also Zero Carbon Record's aesthetic orientation towards the electronic avantgarde relies on a smaller community that cannot be easily reached in geographical terms — making logistics the socio-material focus point in its endeavour.

The socio-material context in Finland, where the image of new, modern, advanced technologies plays a dominant role in all ways of life, commercial organisations are generally eager to show green credentials, so they are looking for collaborations with alternative energy practices. Large events featuring alternative energy sources can potentially raise awareness of energy production and consumption with larger crowds. However, the aforementioned Sun Plugged event in Helsinki, organised by energy company Väre (Väre 2019), who no doubt intended to emphasise their green credentials, gets only 31% of their electricity from renewables, while the remaining 69% is from fossil fuels (35%) including peat (approx. 4%), and nuclear (34%) (Väre 2025). These numbers are in line with the overall energy mix in Finland. This may raise the question of greenwashing (Forliano et.al. 2025) through the exploitation of innovative actors looking for real alternatives. But the absence of more radical low-carbon networks in Finland could potentially be a niche to fill and an opportunity for the many small projects that seem to exist but do not necessarily know of each other.

As to the the socio-material arrangement of the practices themselves, some additional interesting comparisons and or differentiations are possible: Whereas HedgeRig's focus is on playing off grid with a high degree of mobility, ExoSound goes outdoors to enlist the environment as a co-sounding contributor; GaiaStage's focus are the speculative possibilities of smart low tech solutions whereas Zero Carbon Records plays with the restrictions of their absence. What is common to all four cases, is the conscious relational awareness that music happens in a material world, not just as virtual promises accessible on a server, but in a non-digital, muddy, embodied, and earthly place.

As musicians generally travel to reach their audiences, the musician-led initiatives for alternative performance practices require a material *mobility*, in form of lightweight infrastructure, non reliance on fossil fuels, recycling, upcycling — software instead of hardware, a commitment to sustainability at the risk of getting muddy, wet, and cold with sore muscles in good measures, speak of a reduction in materiality towards embodied, social, less material technical interactions. Travel is a very typical socio-material arrangement, where negotiations are paramount to sustainability.

From an economical perspective, it is clear that there are challenges for these alternative socio-material arrangements — although they can start on almost no funds, to reach economical viability, they may have to reach larger audiences, making it more difficult to stay low carbon. For the research-funding backed ExoSound project, these considerations are less of importance than for the others, and GaiaStage managed to get funding for the most recent events from the municipalities where the events took place in. Even though the practices have activist character, they are also an alternative service in an industry, and potentially could even disrupt existing economic structures to some extent. Again, the negotiation of the social dimension is key — not the materiality *per se*.

The most fundamental impact on off-grid musical practices is without doubt the ubiquitous availability of class D amps in mobile devices, active loudspeakers and 12V car HiFi amplifiers. That the technology was developed for the automotive industry is a typical repurposing in maker culture, and can be understood as a form of re-appropriation. Or, returning to machines as reading/writing: When we look at machines as texts, we can read them differently to what the "authors" intended.

That battery design becomes increasingly efficient is a contribution towards off-grid events' feasibility. But their absence in GaiaStage (and Zero Carbon Records) is a political statement about chemical batteries' poor environmental record. Yet, due to their small weight, lithium-ion polymer batteries are potent tools in mobile applications, notwithstanding the potential scarcity of Lithium as a depletable mineral source. Here too, rather than accepting batteries as a determinant material fact, deconstructing them as complex negotiated networks can lead to speculative rethinking of the socio-material arrangement, leading to new ways of reading them.

Transport of people and goods to outdoor events is the most carbon intensive aspect for outdoors events, and low-carbon practices will be most efficient if they start here: The technical solution depends on the social side of the arrangement more than on the material side. As musicians generally travel to reach their audiences, the musician-led initiatives for alternative performance practices require a material mobility: That bricks-and-mortar venues with sustainable stages are far and few between necessitates that the stage goes with the musicians, opening up new ad-hoc venues, wherever opportunity arises on the way. Some of them as micro-performances for small groups, some of them in larger gatherings: In view of the possibility to connect in larger networks, this presents a possible alternative also for more mainstream practices.

Rather than waiting for technical solutions to appear out of thin air, the four initiatives discussed here take technical action, work on alternatives that allow engagement with the material world on ethical terms — not simply as passive consumers but to negotiate their practices as a socio-material arrangement within it.

There is anecdotal evidence that the four micropractices described here may be nurtured by a convergent evolution of ideas — there may be many similar microgroups forming in other places as we speak. One can speculate what potentially is possible if those groups started interacting, last not least, drawing from the vast experience of the UK’s network and travelling cultures — Sylvain Chauveau and Manu Louis’ search for a broader council shall begin. GaiaStage and ExoSound as action research initiatives are well placed to help in the building of such networks, and their cross-disciplinarity allows for broadness too.

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